Ash Development Association of Australia

COAL ASH matters

13 DECEMBER

CCPs - *a valuable resource*

www.adaa.asn.au

THIS ISSUE - DECEMBER 13

Editorial

As another year end approaches, we reflect on the success of the Ash Development Association of Australia (ADAA) and its members. Focusing on regulatory engagement across the States of NSW and QLD, the Association has secured increased regulatory and legal certainty for the sustained and future use of coal combustion products. Since the Association's early beginnings, knowledge development and technology transfer have been a core tenet. This edition reports on research and development activities of the Association's involvement with the CRC for Low Carbon Living, coupled with the various technical publications to further our understanding of coal combustion products (CCPs).

This edition explores the growth of CCPs within the construction materials industry by profiling selected researchers. Greg Johnson provides us with an insight into his career, including geopolymer coffins.

Continuing this alternative use for coal combustion products theme, this edition also focuses on Alexander's Mulch and Soil Supplies and its use of coal combustion products in their soil and landscaping supplies to wholesale markets. The company is currently using coal combustion products as they beneficially increase soil volume, pH and water filtration properties. This is just another example of the beneficial utilisation of CCPs.

The Review of the Coal Combustion Products Handbook is coming to a close with an expected completion date of December 2013. After nearly 2 years of hard work and dedication from both member and non-member authors, this publication represents the foundation of the Association in 'Doing Together What We could not Do Alone' (a phrase coined by the then CEO Frank van Schagen) which is a legacy document from the now concluded CRC for Coal in Sustainable Development.

Industry education events have dominated the recent months of the Association's activities. In this edition we provide a report on conferences such as Concrete 2013, the Australian Society of Concrete Pavements Conference and Coal Ash Asia. These events offered networking opportunities on a national and international scale to increase awareness and potential opportunities for the use of coal combustion products. There are also future events to look forward to with the Construction Materials Industry Conference (CMIC) scheduled for 3-6 September 2014 at the Brisbane Convention Centre. We will seek to keep you updated with key dates and detailed Conference Reports are available later in this addition.

Lastly, the Association would like to wish all members a safe and happy holiday period. We look forward to working with you next year to further the Association's aims to bring benefit to members.

Coal Ash Matters is published by ADAA
The Ash Development Association of Australia
Ph: 02 4228 1389 | Fax: 02 4228 1777
Email: info@adaa.asn.au
Website: www.adaa.asn.au

ISSUE: DECEMBER 2013

COAL ASH EDITORIAL TEAM
Chief Executive Officer: Craig Heidrich
Editor: Olivia Yeatman
Design: 101 Design Pty Ltd
Contributors: Olivia Yeatman, Craig Heidrich, Carol Wilson, Greg Johnson, Tom Glasby, Ray Persini
Coal Ash Matters is a bi-annual publication
Circulation: 2000

Membership

COMPANY MEMBERS

A primary role of the ADAA is to bring together producers and marketers of coal combustion products (CCPs). Our activities cover research and development into CCP usage, advocacy and technical assistance to CCP producers and users, as well as a forum for the exchange and publication of CCP information.

For more information on the Association, visit us at **www.adaa.asn.au**

- Adbri Masonry
- Adbri Resources
- Alinta Energy Group Ltd
- Bulk Flyash Grouts Pty Ltd
- CS Energy Ltd
- Delta Electricity
- Eraring Energy
- Genesis Power Limited
- Golden Bay Cement
- Holcim Pty Ltd
- Hyrock NSW Pty Ltd
- Independent Cement & Lime Pty Ltd
- InterGen Australia (Millmerran)
- International Power
- Keller Mine Fill JV
- LLIS Industrial Pty Ltd
- LoyYang Power
- NRG Gladstone Power Station
- Nucrush Pty Ltd
- Rio Tinto
- Roads And Maritime Services
- Stanwell Corporation
- Sunstate Cement Ltd
- TRUenergy
- Vecor Ltd
- Verve Energy
- Wagners Cement
- Weston Matrix

RELATED ASSOCIATIONS

- CSIRO www.smit.csiro.au
- Association of Canadian Industries Recycling Coal Ash (CIRCA) www.circainfo.ca
- UK Quality Ash Association www.ukqaa.org.uk
- American Coal Ash Association www.acaa-usa.org
- World Wide Coal Combustion Products Network (WWCCPN) www.wwccpn.org

2013 BPN Sustainability Awards

On the 21st November 2013, Wagners were awarded the Best of the Best Award at Australia's BPN Sustainability Awards for the use of their "Earth Friendly Concrete" (EFC), a proprietary geopolymer concrete, in the multi-rise Global Change Institute building (GCI) at the University of Queensland.

Geopolymer concrete is not a new technology but one that is finally emerging in a growing number of commercial applications such as the ground breaking GCI structure where the 3 suspended floors are precast EFC floor beams that span 10.5 m. The carbon reduction potential of this technology impressed the judges of the BPN Awards.

"This kind of product offers an immediate path to low embodied energy buildings, and provides long term opportunities to feed into the design and building process of almost all buildings in Australia and the world".

Tom Glasby, Earth Friendly Concrete Manager at Wagners outlined that EFC was the result of over 8 years development by the Wagners technical team which has seen significant advances in the past 18 months. EFC is completely cement free and is comprised of sand, aggregate, fly ash, slag, unique activator chemicals and purpose made admixtures. EFC has similar plastic state properties as normal concrete and can be produced and delivered using existing methods. Apart from its environmental credentials, EFC is a high performance concrete with very low shrinkage and extremely high resistance to sulphate attack and chloride ingress.

Congratulations to Association Members, Wagners Cement, on their award-winning innovative product. This looks to be a sign of things to come as CCPs are continually used to improve sustainability objectives.

For more information of Wagner's Earth Friendly Concrete, please visit: http://www.wagner.com.au/capabilities/efc/

SUCCESS!!: NSW EPA Exemption Amendments Gazetted

Following some 24 months of briefings, meetings and submissions of additional research materials to Waste & Resource Strategy of the Environment Protection Authority (EPA) NSW responsible for administering Waste & Resource Recovery, the EPA gazetted amendments to the General Exemption for coal combustion products. This lengthy and difficult, but necessary, consultation process as required in order to obtain the right outcome for our members.

In summary, the amended General Exemption (http://www.epa.nsw.gov.au/resources/waste/ex13coalash.pdf) incorporates a number of specific changes proposed by the ADAA which will have wider, positive benefits in increasing the beneficial utilisation of coal combustion products in both NSW and other jurisdictions.

The main changes include:

- Conditions for low pH coal ash use are now incorporated into the exemption where low pH coal ash can be blended, equal to 20% with approved materials such as lime, natural quarried rock, coal ash, coal washery rejects, recovered railway ballast and crushed concrete
- A definition for cementitious applications is now incorporated with significantly reduced testing and reporting requirements for all supply chain participants
- A definition for non-cementitious applications has now been incorporated to clarify applications. Restrictions for use of coal ash in water have now been removed for cementitious applications
- Other minor amendments for test methods have been made which reduce testing cost burden

Apart from these changes, all other conditions remain unchanged from the 2010 version. This outcome is just another example of 'Doing together what we could not do alone' through the Association. In particular we would like to thank selected members for their involvement and assistance: Garry Craig - Eraring Energy, Justin Flood - Delta Electricity, Professor Colin Ward - UNSW, Dr Jane Aiken - LendLease and Roy Butcher and Dr Daksh Baweja from EMS.

For further information on the Exemption, please visit: http://www.epa.nsw.gov.au/resources/waste/ex13coalash.pdf

WHERE ARE THEY NOW? **Greg Johnson**

Well, it has been quite a ride since entering the concrete industry 36 years ago. One thing is for sure, it has always been interesting, not only for the research and development (R&D) projects I have been involved in but also because of the people I have met along the way.

My initiation into concrete was in 1977 when I was employed as an analyst at the Readymix Central Research Laboratory, located at North Ryde in Sydney. Previously I had worked as a Chemist for 3 years but I wanted to use my geology training and I hoped that concrete would provide that opportunity. The analysis I performed actually involved more chemistry than geology but I did meet some great workmates and also interacted with some of the most knowledgeable people in the industry – Alek Samarin and Bob Munn.

The analysis of cement and concrete was interesting but not challenging so within a few years I transferred to the newly formed Relcrete division of Monier where I worked with Barry Butler and later, John Ashby, as their Research Chemist. This is where I discovered my passion for R&D and I started development on many of the products that Relcrete supplied being concrete admixtures, fly ash, bagmix grouts and road blends.

It was around this time that 'concrete cancer' was a hot topic so I developed a range of non-chloride accelerating admixtures which were sold as the AcN series. I also developed a new version of 40C non-shrink grout and a range of road blends which were known throughout the industry as the Relcrete 'Triple Blends'.

Since Relcrete was a major supplier of fly ash, I investigated means of improving its performance and found that this could be achieved by grinding the ash to a suitable size range. This led to the mechano-chemical activation of fly ash, which was a project performed in association with the University of Western Australia and involved grinding the ash in an attritor mill along with suitable chemical activators. After many batch trials at the Vales Point Fly Ash Plant, the process was patented and a commercial plant set up at Bayswater to produce a very reactive ash known as SolidFlow.

In 1995, I transferred to the Technology Section of Rocla Pipe where I continued doing development work on concrete products alongside Geoff West, Chris Busck and Terry Gourley. It was around this time that I started research on geopolymer concrete which had just started to attract some interest as an alternative building material.

Geopolymer concrete has many similarities to conventional concrete but it is the differences that attract most attention. It is considerably more acid resistant than OPC concrete, which gives it an advantage in acidic environments such as acid sulphate soils and sewer pipe lines. The problem is that the polymerisation reaction has to be controlled and this was finally achieved after many lab and plant trials. A formulation and associated process were patented for making geopolymer pipes but surprisingly the first commercial production of a geopolymer product by Rocla was burial crypts. In this case geopolymer concrete was chosen for its low carbon footprint due to the absence of cement. Over 2000 tonnes of the concrete was produced to make 945 grave sites which were installed at Woronora Cemetery in Sydney.

Currently I am still working at Rocla, doing research on geopolymer concrete and also concrete mix optimisation based on rheological data inputs.

Career Summary

1974	BSc (geology major) from the University of NSW
1977 - 1978	Analyst for Readymix Concrete Ltd. - Central Research Laboratory at North Ryde
1978 - 1985	Research Chemist for Monier Relcrete at Villawood
1985 - 1995	Laboratory Manager for Rocla – Relcrete at Villawood
1995 - 2013	Senior Development Scientist for Rocla Pipe and Quarry Products at Guildford

Coal Combustion Handbook Review Update

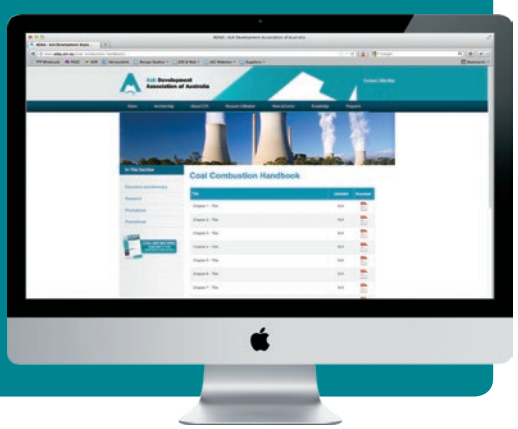
The review of the Coal Combustion Products Handbook is expected to conclude in December 2013. Since the proposal for this project, authors and contributors have been working towards the design and completion of drafts for each chapter.

To reiterate the original aims of the update, the purpose of this project was to update existing and new information with research for application in market developments and the distillation of trends. This new research also incorporates legislative changes in the form of exemptions to incorporate the changing face of CCP applications.

At this stage, the majority of chapters have been completed and circulated for member review. Future progress requires:

- Revision and confirmation of data to meet current standards
- Final sign-off on content
- Proofing and publication

The ADAA would like to thank the authors, contributors and members for their hard work throughout this long-term project. By continually updating our technical information, we can ensure both quality and relevance to stakeholders and the general public alike.



Ash Development Association of Australia

USE OF COAL COMBUSTION PRODUCTS AS CONSTRUCTION MATERIAL COMPONENTS

Fly Ash Reference Data Sheet NO. 3
2013

1. INTRODUCTION

Coal Combustion Products (CCPs) are the by-products generated from the combustion of pulverised coal in coal-fired boilers used for power generation. These products include a finer component called fly ash and a coarse component called furnace bottom ash. Furnace bottom ash is collected from the bottom of the combustion chamber whilst fly ash is separated from the flue gas by either electrostatic precipitation or fabric filtration prior to the discharge of the clean flue gas into the atmosphere. Therefore CCPs generally fall into two broad categories.

In Australia, the use of CCPs has increased over time. The most common beneficial use of fly ash is as a Supplementary Cementitious Material (SCM) in blended cement and concrete manufacture [1, 2]. During 2011, approximately 14 million tonnes of CCPs were produced in Australia of which approximately 2 million tonnes of fly ash was used as supplementary cementitious materials in cement based and concrete applications. Another 4 million tonnes was used in various civil and structural applications not specifically addressed in Australian Standards or in State Road Authority Specifications.

This reference data sheet considers the types of CCPs that are currently produced at coal fired power stations and the types of applications where they provide beneficial use opportunities as components of construction materials.

2. COAL COMBUSTION PRODUCTS (CCPS)

2.1 TYPES AND CLASSIFICATION

As indicated, CCPs fall into two broad groups of materials, fly ash and furnace bottom ash.

Fly ash is described in Australian Standard AS 3582.1 [3] as a 'solid material extracted from the flue gases of a boiler fired with pulverized coal'. Whilst typically used as an SCM, this definition also applies to materials not specifically complying with the requirements of AS 3582.1.

Fly ash is composed of mostly silica and aluminium oxide species, being a fine material ranging in size between 1 µm and 300 µm, with a rounded rather than angular shape. Its colour is generally light to mid-grey with an amorphous (glassy and non-crystalline) structure resulting in the material having pozzolanic properties meaning that it will react with calcium hydroxide produced by the reaction of lime or cement and water, to produce additional cementitious or binding compounds. The composition of these particles is not crystalline and is termed amorphous (glass, non-crystalline). These amorphous particles contribute to the fly ash having pozzolanic properties [1, 2].

Furnace bottom ash comprises mainly agglomerated or fused particles that are too large to be carried in the flue gases. These particles instead fall to an ash collection point at the bottom of the furnace. Furnace bottom ashes have a similar chemical composition to fly ash.

There are a number of sub-classifications or grades for fly ash and furnace bottom ash. These are:-

- Fly Ash Grades
  - » Graded (AS 3582.1)
  - » Ungraded or Run of Station
- Furnace Bottom Ash
  - » Graded
  - » Ungraded or Run of Station

The terms 'Graded' and 'Ungraded' are described below:

- Graded - a material that has been processed, selected or classified to meet specific grading and property requirements
- Ungraded - a material that has not been processed/ classified or selected to meet specific grading and property requirements

Ash from each power station will have unique properties that are generally suitable for use as construction material components. Significant quantities of material are available for further processing, blending and application. These materials are available from a number of sources and in the forms described below.

2.2 FLY ASH MATERIAL AVAILABILITY

Ungraded fly ash is separated from flue gasses by electrostatic precipitation or fabric filtration prior to transport to processing facilities or ash storage silos where it becomes available for collection and transport. Ash from each power station will generally exhibit specific characteristics that also makes it useful as a construction material component.

Fly ash that is not immediately required for beneficial use is also routinely transported to dedicated ash storage facilities of different types located adjacent to the power station.

These include:

1. Dry Placement: Ungraded fly ash is conditioned with water and conveyed by truck or conveyor for placement
2. Dense Phase Placement: Ungraded fly ash is mixed with water to create a dense phase materials prior to pumping to a final storage location

Coal fired power stations have traditionally used dense phase placement systems due to simplicity and low operating costs. Stored materials can be recovered for beneficial reuse but properties may need to be re-assessed prior to use.

Graded fly ash, as discussed previously, is extensively used in the manufacture of blended cements and as an SCM in concrete [1, 2]. Australian Standard AS 3582.1 sets out the specification requirements for fine, medium and coarse grade as shown in Table 1 below.

Grade	Fineness % passing 45 µm sieve	Loss on ignition Max %	Moisture content Max %	SO3 content Max %
Fine	75	4.0	1.0	3.0
Medium	65	5.0	1.0	3.0
Coarse	55	6.0	1.0	3.0
Ref. Test Method (AS)	3583.1	3583.3	3583.2	3583.8

Table 1: Fly Ash as defined in AS 3582.1

In addition to the properties listed in Table 1, there are a number of other characteristics relevant to SCM performance including:

- Available alkali content
- Relative density
- Relative water requirement
- Relative strength

2.3 FURNACE (BOTTOM) ASH

Furnace (bottom) ash (FBA) is composed of agglomerated ash particles collected at the base of the furnace or combustion chamber of the power station boiler. Furnace bottom ash can be collected wet or dry, depending on the power station configuration and transferred to dedicated storage locations. This material is often grey to black in colour (although some materials can be white), with angular shaped particles and a porous surface structure. The grain size of furnace bottom ash ranges from fine sand to fine gravel (greater than 5 mm size). Typically, the particle size for FBA is typically 0.1 mm to 30 mm although most commonly less than 20 mm in size [4, 5, 6].

Furnace bottom ash can be collected and processed from the ash repository. The method of collection will depend on the actual beneficial use. Following collection, the required characteristics applicable to the proposed final beneficial use may need to be reconfirmed.

3. APPLICATION OF CCPS

3.1 GENERAL

As previously indicated, fly ash is most commonly used in SCM applications while furnace bottom ash is mainly used in construction applications as fine and course aggregate. Due to the properties and characteristics of these materials, various other applications in other fields have been reported [7, 8, 9, 10, 11].

Some of these include:-

- Oil well cement (for application in the drilling of oil wells where high temperatures prevail)
- Decorative glass
- Ceramic fibres
- Tiles
- Synthetic marble
- Reflective material
- Continuous casting mould powder
- Domestic cleaning powder
- Synthetic wood
- Alumina, magnetite, iron, carbon and cenospheres in mineral extraction
- Glass ceramics
- Foam insulation products
- Anti-corrosion coatings
- Synthetic zeolites
- Agriculture and soil amendment
- Potassium silicate fertilizer
- Manufactured aggregates

Whilst the list of potential applications for CCPs are extensive, the focus of this data sheet relates specifically to construction materials as this area is considered to have the greatest bulk usage potential for such materials. Currently in Australia, other than as cementitious binders in concrete, CCPs have had limited use as construction materials in:-

- Structural fills, aggregates and mine rehabilitation
- Mineral fillers
- Waste stabilization and solidification
- Road and pavement materials

In the following sections, detailed information relating to the following applications is described as these areas present the most potential for significant beneficial use:-

- Road and pavement construction
- Manufactured aggregates
- Filler and grout applications, and
- Structural fills

3.2 ROAD AND PAVEMENT CONSTRUCTION

CCPs are used worldwide in pavement and road construction. For these applications, the ADAA can provide information relating to pavement construction [4] and road stabilisation [12, 13]. Due to the consistent particle size relative to other pavement material components, these products can be used in most pavement layers [4, 13] with some roads and pavement construction applications for each summarised below:-

- Fly ash
  - » Ingredient in soil modification and/or stabilisation
  - » Component in road bases, sub bases, and pavement
  - » Ingredient in waste stabilisation and/or solidification

- Furnace bottom ash
  - » Where settlement of the sub grade is of concern in embankments on soft or poor ground conditions
  - » Aggregate in road bases, sub bases, and pavement

There are a large number of industrial pavement applications requiring sub base and sub grade layers used to support traffic loads within distribution and warehouse type facilities. CCPs can enhance such pavement layers by modifying the structure of such layer blends and also in the case of fly ash, its pozzolanic nature can be used to increase bearing capacity. Importantly, fly ash does not necessarily need to conform to the requirements of AS 3582.1 to be effective in such applications.

In the last few decades, due to increasing traffic loads, roads have required increasing levels of rehabilitation and maintenance, and thus increased cost. Using CCPs not only helps to reduce

maintenance costs through product improvements, but also is environmentally beneficial as the use of CCPs contributes to the conservation of natural resources which would otherwise be used.

3.3 MANUFACTURED (AGGLOMERATED) AGGREGATES

CCPs can also be used as manufactured aggregates or in combination with natural aggregates. Generally, coarser CCPs, specifically furnace bottom ash, are used for this purpose. Due to the particle size of furnace bottom ash, it can be used as a replacement for aggregate and is usually sufficiently well-graded in size to avoid the need for blending with other fine aggregates to meet grading requirements. Furnace bottom ash particles have a porous surface structure and are less dense than conventional natural aggregate. It is generally beneficial to use FBA in base course and shoulder material blends or in cold mix applications for pavement construction. Furnace bottom ash is also potentially beneficial as a lightweight concrete aggregate.

3.4 FILLERS AND GROUTS (INCLUDING STRUCTURAL FILL)

Coal combustion products are used as fillers within slurried material mixes and in grouts. These applications have traditionally had specified graded (fine) fly ash as referenced in AS 3582.1. However in many filler and grout applications it is not necessary to use specially selected material conforming to AS 3582.1 as ungraded fly ash described earlier would be directly applicable and could potentially fit such applications more closely with having the presence of coarser particle fractions.

The incorporation of fly ash improves the fluidity of flowable fill and grouts. Specifically, the shape and particle size distribution of fly ash makes it a good mineral filler, for example in asphaltic concrete applications. The most common applications for CCP based fillers are found in building and road construction. These include:-

- Fly ash
  - » Component of flowable fill
  - » Fill material for structural applications and embankments [5]
  - » Mineral filler in asphalt

- Furnace bottom ash
  - » Fill material for structural applications and embankments [5]
  - » Concrete aggregate
  - » Aggregate for masonry unit manufacture
  - » Improvement of sub grade conditions where settlement is of concern in embankment construction

4. CONCLUSION

Whilst fly ash is extensively used in cement and concrete related applications, this reference data sheet explores many other potential applications for fly ash use in road construction, structural and non-structural fills and as fillers and in grout applications. Furnace bottom ash also has a range of uses in fine and coarse aggregate applications where natural aggregates are used. By utilizing CCPs in such applications, there are dual benefits of being able to provide construction materials having improved quality as well as having a positive influence on sustainability through reduced CO_2 emissions, reduced depletion of natural resources and reduced requirements for disposal and storage of material at power stations.

Fly ash and furnace bottom ash are available as graded or ungraded materials. Material sources across the power station include:-

- Classifiers
- Precipitators
- Ash hoppers
- Interim storage (bins)
- Ash repository (dam)

The Association recommends testing be conducted on each material source to ensure that its properties and characteristics are clearly known.

REFERENCES

1. Ash Development Association of Australia (ADAA), "Guide to the Use of Fly Ash in Concrete in Australia", Fly Ash Reference Data Sheet No. 1, Available from http://www.adaa.asn.au/refdatasheets.htm, August, 2009, 4p.

2. Ash Development Association of Australia (ADAA), "Australian Experience with Fly Ash in Concrete: Applications and Opportunities", Fly Ash Technical Note No. 8, Available from http://www.adaa.asn.au/technicalnotes.htm, November, 2009, 4p.

3. Standards Australia, Australian Standard AS 3582.1, "Supplementary Cementitious Materials for Use With Portland and Blended Cement – Part 1: Fly Ash", ISBN 0 7337 1688 1, SAI Global, 1998.

4. Ash Development Association of Australia (ADAA), "Pavement Construction and the Role of Coal Combustion Products", Technical Note No. 5, Available from http://www.adaa.asn.au/documents/Technical_Notes_5.pdf, 2012, 4p.

5. Ash Development Association of Australia (ADAA), "Structural Fills and the Role of Coal Combustion Products", Technical Note No. 6, Available from http://www.adaa.asn.au/documents/Technical_Notes_6.pdf, 2012, 4p.

6. Cement Concrete and Aggregates Australia, "Use of Recycled Aggregates in Construction", CCAA Technical Report, Available from www.ccaa.com.au, October, 2008, 26p.

7. Demirbas, A., "Potential applications of Renewable Energy Sources, Biomass Combustion Problems in Boiler Power Systems and Combustion Related Environmental Issues", Progress in Energy and Combustion Science, 2005. 31(2): p. 171-192.

8. Demirbas, A., "Potential Applications of Renewable Energy Sources, Biomass Combustion Problems in Boiler Power Systems and Combustion Related Environmental Issues". Fuel and Energy Abstracts, 2005. 46(6): p. 387-388.

9. Murarka, I.P and Erickson, J, "Use of Coal Combustion Products in Mine-Filling Applications: A Review of Available Literature and Case Studies", Final Report Reference DOE Award No: 99-CBRC, American Coal Ash Association, Oct, 2006.

10. Technology Information, Forecasting and Assessment Council (TIFAC), "High Value Added Products and Applications of Flyash", Department of Science and Technology, Government of India, Code No: TMS101, http://www.tifac.org.in, 2009.

11. Nebraska Department of Environmental Quality (NDEQ), "Beneficial Use of Coal Combustion By-Products, Steel Manufacturing By-Products, and Other Similar Materials", NDOE Environmental Guidance Document, 06-212, 2007.

12. Ash Development Association of Australia (ADAA), "Fly Ash Blended Binders for Road Stabilisation", Reference Data Sheet No. 7, Available from http://www.adaa.asn.au/documents/Ref_Data_Sheet_7.pdf, 2005, 2p.

13. Ash Development Association of Australia (ADAA), "Modified and Stabilised Construction Materials Incorporating Coal Combustion Products", Reference Data Sheet No 13.

14. Available from http://www.adaa.asn.au/documents/Ref_Data_Sheet_13.pdf, 2012, 5p.

ASH DEVELOPMENT ASSOCIATION OF AUSTRALIA (ADAA)

PO Box 1194 Wollongong NSW 2500 Australia
Telephone: +612 4228 1389 / Fax: +612 4228 1777
Email: adaa@adaa.asn.au / Web: www.adaa.asn.au

Progress for the CRC for Low Carbon Living

The CRC for Low Carbon Living hosted a two day Participants and Researchers Forum in Sydney on 24-25 October 2013. The event tracked progress of current research projects and provided an opportunity for researchers, participants and other stakeholders to get together to explore end-user needs and develop ideas and concepts for the next round of projects. - See more at: http://www.lowcarbonlivingcrc.com.au/EventCRCforLowCarbonLivingParticipantandResearchersForum.html

The Association participated in a series of workshops over the course of the two days. Craig Heidrich, CEO participated in the panel discussion and provided a brief presentation during the ***Buildings, systems and integration*** workshop chaired by David Parken - The Australian Institute of Architects.

CRC participants and researchers were informed about progress of the first year projects and highlights from research findings. Australian buildings emit approximately 150 MT of CO_2^{-e} per annum and under business as usual this is expected to grow to 275 MT of CO_2^{-e} by 2050. However the pursuit of energy efficiency could limit these emissions to be more like 200 MT of CO_2^{-e} by 2050. Craig Heidrich, using the ***'Pressure, State, Response'*** model - shared perspectives on challenges to be confronted moving towards and overcoming the barriers to low carbon concretes.

A lively question and answer session followed with a number of questions from the floor. Ultimately the session provided a good overview of year 1 activities which stimulated a lot of interest from the audience and hopefully planted some seeds for the next round of CRC research projects in this area.

Within ***Program 1 - Buildings, systems and integration,*** a number of projects are currently under review. One project addresses low carbon concretes using alternatives to the conventional Portland cement and barriers to be overcome before entering the mainstream of concrete construction.

The project on low carbon materials aimed to identify the barriers to their widespread adoption in industry. The main barrier identified was the lack of standard specifications that included this material. Indeed, design of plain, reinforced and prestressed concrete in codes and standards such as AS 3600 implicitly assume that the concrete is based on Portland cement. Therefore it has been determined that the pathway to overcome this barrier is to develop a Standard Test Methods Handbook for Low Carbon Concrete mix design through Standards Australia to assist engineers and end-users in specifying and using low carbon concrete with greater confidence and less risk.

Another important part of the project is the development of synthetic or artificial aggregates manufactured from coal combustion by-products that may be used in either GC or OPC concrete. Indeed, the rapid depletion of quality natural aggregate quarry sources close to most major metropolitan regions of Australia has emphasised the need to explore alternative economic sources to support increasing vital infrastructure development, including housing, roads, bridges, schools and hospitals.

For more information on the CRC for Low Carbon living, please visit: http://www.lowcarbonlivingcrc.com.au

UPDATE
ADAA Technical Documents

The National Technical Committee has continued to push forward on the update of technical literature produced by the Association in the past years. Of the 9 documents identified for review, a number have been published with assistance and technical guidance from ADAA members. Our member base is crucial to the review of these documents in providing a current, industry leading perspective on present and future applications of CCPs.

A number of technical documents have recently been published and uploaded to the ADAA website. These include the most recently published, *Reference Data Sheet 3: Use of Coal Combustion Products as Construction Material Components* which is an insert in this edition.

In 2014, the Association plans to publish several new Technical Notes including *Technical Note 12: CO_2 Benefits of Using CCPs* and *Technical Note 13: NORMS in Australian CCPs*. Both of these publications focus on emerging areas of interest in the industry including the significant contribution that coal combustion products have made to the reduction of carbon emissions in the otherwise carbon-intensive construction materials production process.

The Ash Development Association of Australia would like to thank our members for their contribution to the collaborative draft and design on these documents. Their efforts ensure the success of such publications and that the information published is timely and relevant to the current industry position.

Title	Status
Pavement Construction and the Role of Coal Combustion products (TN 5)	Published
Structural Fills and the Role of Coal Combustion Products (TN 6)	Published
Use of Fly Ash to Achieve Enhanced Sustainability in Construction (TN 11)	Published
CO_2 Benefits Using CCPs (TN 12)	Drafting
NORMS (TN 13)	Drafting
Use of Coal Combustion Products as Construction Material Components (RDS 3)	Published
Coal Combustion Products in Roller Compacted Concrete (RDS 10)	Published
CCPs for Soil Applications, Horticultural and Agricultural Assessment (RDS 11)	Scope
CCPs for Soil Applications, Horticultural and Agricultural Applications (RDS 12)	Scope
Modified and Stabilised Coal Combustion Products (RDS 13)	Published

BUSINESS OVERVIEW:
Alexander's Mulch and Soil Supplies

Alexander's Mulch and Soil Supplies is located at Mandalong on the NSW Central Coast and has been owned by Ray Persini for 7 years. This business is specialised to cater for a handful of wholesale markets mainly on the Central Coast and North of Sydney, supplying various soil types mainly to retail landscaping companies.

This business is also relevant in that it uses furnace bottom ash from local suppliers in a number of products. The furnace bottom ash (FBA) type and application of each material is described below:

FBA Type	Supplier	Application	Beneficial Properties
7 mm aggregate	Eraring Energy	Potting mix/additive	• Allows for air and water filtration • Raises pH slightly • Alternative to sand/pebbles because it is lighter
9 mm minus ash	Howard's Recycling (Vales Point)	Other soil products eg. soil conditioner	• Prevents soil from binding together • Makes soil lighter, increases volume • Raises pH slightly • Alternative to sand/pebbles because it is lighter

In terms of the FBA suppliers, Eraring provides both the 7 mm and 9 mm aggregate. The 7 mm aggregate is a unique product as it is only obtained through wet screening. Additionally, the 9 mm aggregate is much cheaper in comparison to natural substances and potentially performs better due to it's lighter weight.

Howard's Recycling supplies FBA from Vales point in the form of 9 mm minus ash and is soon to supply the 7 mm aggregate as well.

This business demonstrates yet another beneficial use of CCP materials in an unexpected application area.

CONFERENCE REPORT
Australian Society of Concrete Pavements

On Monday 12 August 2013, the ADAA attended the *ASCP 2013: Concrete Pavements Conference* at the Australian National Maritime Museum, Darling Harbour, Sydney.

This one day technical event aimed to provide the industry with current and relevant information about concrete pavement design, construction, materials and equipment from within Australia and internationally. Additionally, the Museum location provided an interesting venue with access to a large number of maritime historical artefacts.

With 10 presentations, coupled with a number of discussion sessions, this Conference offered delegates tailored information on specific topics and the opportunity to discuss concepts and ideas with presenters and colleagues alike.

The Association encourages members to attend such events as they afford a valuable technical and professional networking opportunity in industry-related fields. We look forward to the next ASCP conference in 2015.

ASCP
AUSTRALIAN SOCIETY FOR CONCRETE PAVEMENTS

For more information on the ASCP, please visit: http://www.concretepavements.com.au

CONFERENCE REPORT
World of Coal Ash (WOCA)

Craig Heidrich, on behalf of the ADAA attended the 5th biennial World of Coal Ash (WOCA) in April this year at Lexington, Kentucky. This event was organised by the American Coal Ash Association (ACAA) and the University of Kentucky's Center for Applied Energy Research (CAER) and focused on the sustainability of coal ash and its applications worldwide from a scientific perspective.

Craig presented two papers and a co-authored keynote address which focused on the Australian legislative environment in comparison to that seen in the US, demonstrating the international forum provided. Organisers sought to improve on previous numbers from 2011 and included a number of CCB/CCP related topics being:

- Utilisation of coal ash and flue gas desulfurization materials
- Sustainable projects using CCPs
- Emerging technologies
- General ash management (including disposal)
- Mercury related topics
- Recent research and specific case studies
- International activities
- Regulatory topics from local, State and Federal perspectives

WOCA 2013 provided an excellent opportunity for the ADAA to continue working with other countries to incorporate CCP utilisation into new facets of industry.

For more information, please visit: http://www.worldofcoalash.org

CONFERENCE REPORT
Conference Report: Coal Ash Asia 2013

Coal Ash Asia 2013 was held on 5th - 7th September 2013 in Shuozhou City, Shanxi Province, China. Craig Heidrich attended on behalf of the ADAA and presented the Keynote Address. The central theme of this conference was the science and business of coal ash utilization and was organized by the Chinese Institute for Technical information for the Building Materials Industry, China. This event was hosted by the Municipal Government of Shuozhou, in conjunction with the Asian Coal Ash Association (ACAA).

The Asian Coal Ash Association and it's members conduct and contribute research on market and technical developments in the coal combustion by-products industry. In 2010, the Association launched a program that reflected its education objectives by collecting and publishing industry information for members, the media and the general public in order to increase the understanding of coal ash utilisation technologies and benefits. Updated reports are expected to be made available in the first half of 2014.

Key events from Coal Ash Asia 2013 included:

- The introduction of a new 3 million square meter coal ash utilization industrial park in Shuozhou City
- The launch of a US$30 million coal ash investment fund
- The establishment of the Asian Coal Ash Research and Development Centre

There was a truly international presence with 528 participants from 258 enterprises, university and research institutes. The participation of international companies and researchers was especially strong, with more than 20 international delegates representing more than 10 different countries. This demonstrated the recognised valuable networking and knowledge transfer opportunities made available.

For more information on the Asian Coal Ash Association, please visit: http://www.asiancoalash.org

CONFERENCE REPORT
Concrete 2013!

The Concrete Institute of Australia's Biennial National Conference, *Concrete 2013* was held at the Gold Coast Convention and Exhibition Centre, Gold Coast, Queensland from 16 to 18 October, 2013.

Conference highlights included:
- 5 keynote speakers, 75 sessions, 15 award posters
- 480 registrants networking, listening and learning from the best in the field
- 44 exhibiting companies, 11 sponsors

The broad theme of the conference was 'Understanding Concrete', covering materials, research, design, construction and innovation. The conference provided a forum for the sharing of ideas and experience through formal presentations, industry displays and informal contact between delegates. It was the concrete industry's pre-eminent technical and social event in the Southern Hemisphere for 2013.

The technical program was of value to practising civil and structural engineers, engineering academics, concrete product manufacturers, civil and building contractors, developers, Government Departments covering transport, roads, railways and public works and local Government shires and councils.

One of the main themes that arose from this conference was the growing popularity of fly ash materials and their use in geopolymers. This product was represented in a number of sessions including Structures Research and Applications (5 Sessions), Concrete Materials and Performance (3 Sessions) and Geopolymer Concrete (3 Sessions). This indicates yet another innovative field for the continued beneficial utilisation of coal combustion products (CCPs).

The Association received a positive response from Conference delegates and fellow exhibitors. There were a number of enquiries ranging from membership interest, obtaining samples for research programs to general interest in our aims and activities. These events are important to the education and technical foundations of the Association because it brings members together with other industry stakeholders to encourage knowledge transfer.

The Association would also like to thank Roy Butcher and Joanne Portella from Engineered Material Solutions for their technical assistance on the stand throughout the conference. Concrete 2015 will be held from 30 August until 2 September 2015 at the Pullman, Albert Park, Melbourne.
For more information, visit: http://concrete2015.com.au

COMING UP
Construction Materials Industry Conference (CMIC) 2014

The Construction Materials Industry Conference (CMIC) 2014 is on again and is scheduled for Wednesday 3rd until Saturday 6th September 2014 at the Brisbane Convention and Exhibition Centre.

The theme for this conference is one which is foundational to the current market climate being 'Building Productivity' and is presented by the Institute of Quarrying Australia (IQA) in conjunction with the Cement Concrete Aggregates Australia (CCAA).

Expressions of Interest for attendance and paper submissions are now open, however important key dates are:
- **December 2013:** Call for Abstracts open
- **April-June 2014:** Early Bird Registration
- **May 2014:** Speakers notified of Abstract Status

The Association will be be manning a stand in the Exhibition Hall and we encourage our members to attend to take part in this valuable networking opportunity.

We will seek to bring you further updates in the next edition of Coal Ash Matters in April 2014.
For more information, visit: http://www.iceaustralia.com/cmic14/index.php#.UnLpgRZE6gw